

Pollution: The Basics

5.1.1 Define the term pollution

- The addition to the biosphere of substances or agents by a human activity @ a greater rate than the environment can deal with it.

Can also be caused by natural elements: ex. Red Tide or Volcanoes

5.1.2 Distinguish between the terms point-source pollution and non-point source pollution, and outline the challenges they present for management

Point Source Pollution

ex. Chernobyl
Bhopal Disaster
pollution from a specific factory (Baeing)

- ↳ discrete sources of contaminants
- ↳ can be tracked back to a source

Easy(er) to manage

- easy to regulate/control
- place responsibility
- take legal action
- clean up local area
- easy to monitor

Non-Point Source Pollution

ex. vehicle
agricultural runoff

- ↳ dispersed sources of contaminants
- ↳ Very hard/impossible to track

Very hard to manage & regulate

- extensive survey for monitoring
- Big changes required to fix
- many groups share responsib.

5.1.3 State the major sources of pollution

Source	Type of Pollution	Cause	Effects
Agricultural	Salination	Irrigation	Plants die, impacts on agriculture and societies food production
	Pesticides	Spraying of crops	Concentrates higher up food chain or in sediments
	Fertilisers, manure or silage	Spreading fertilizer on fields, manure and silage wash down slopes	Organic pollution reduces oxygen in water courses and causes eutrophication
Industrial and Manufacturing	Toxic spills and leaks	Industrial accidents and dumping	Can be fatal e.g. Bhopal
	Solid waste (chemical cocktail)	Disposal of by products and waste	Various, can be fatal e.g. Love Canal
	Nuclear waste	From nuclear power stations, low grade waste in underground stores	If radiation from source is not controlled it can cause cancer (carcinogen)
Domestic	Sewage	Waste from toilets and drains	Eutrophication, low oxygen in water and disease
	Solid waste (rubbish/garbage)	Waste in land fill sites	Can contaminate groundwater and releases methane
Transport	Road run off (chemical cocktail)	Drainage from roads	Can contaminate groundwater and coastal waters
Fossil fuels	Sulphur dioxide	Burning coal for heat or electricity generation	Acid rain
	Nitrogen oxides	Formed from atmospheric nitrogen in engines	Acid rain, eutrophication
	Particulates	Particulates from any combustion	Causes respiratory problems e.g. bronchitis

Table 5.2 Sources of pollutants

Measure Results of
Pollutants NOT Pollutant
HSELF

↑ BOD = ↓ levels of O_2

Indirect Methods for Measuring Pollution

5.2.2 Define the term biochemical oxygen demand (BOD) and explain how this indirect method is used to assess pollution levels in water

Aerobic Organisms use O_2 during cell Respiration → BOD determined by # of orgs & rate of Respiration

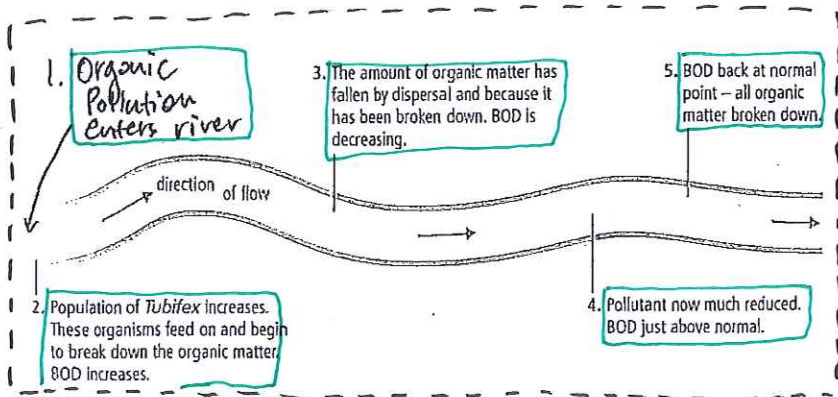
Organic Pollutants → increase in orgs that feed on O. pollutants → these orgs use up O_2 → HIGH BOD

* BOD = BIOLOGICAL OXYGEN DEMAND

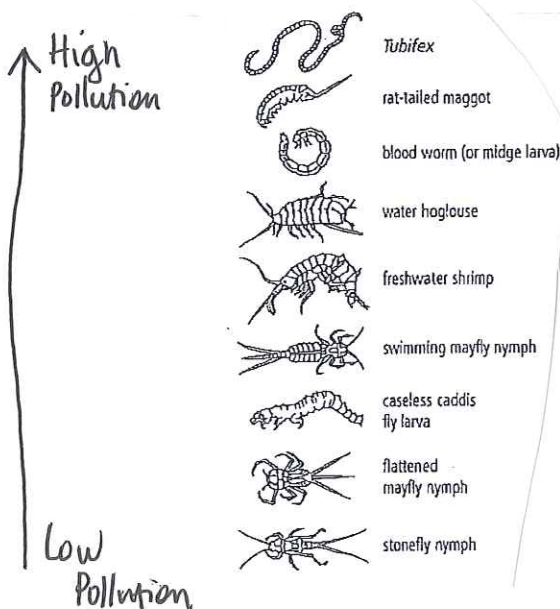
How to ✓ for BOD

- ① Sample of H_2O in a measured volume
- ② Measure O_2 level
- ③ Place in Dark @ $20^\circ C$ for 5 days
- ④ After 5 days measure O_2
- ⑤ BOD = Measurement 1 - measurement 2

Can also be used in conjunction with INDICATOR SPECIES



5.2.3 Describe and explain an indirect method of measuring pollution levels using a biotic index



Low BD

High Biodiversity

gives a measurement of the quality of an ecosystem by the presence or absence of organisms

Cont.
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- Tolerant Spp. are able to deal with high levels of pollutants (not necess. all pollutants, but some)
Tubifex
ex. worms, maggots, blood worm
- Moderately Tolerant Spp are able to deal with medium levels of pollutants
ex. freshwater shrimps, ^{swimming} mayfly nymph
- Sensitive Spp - can't deal w/ any pollutants
ex. stonefly nymph.

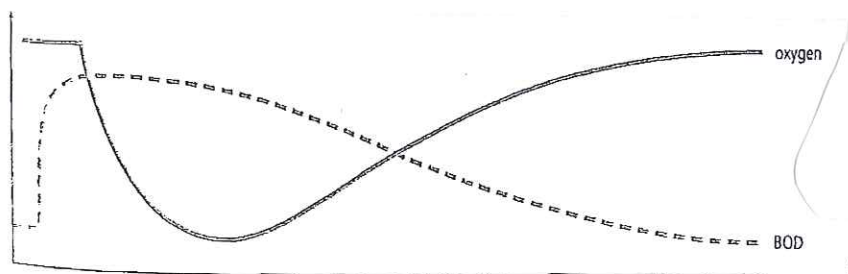
↳ Count # of spp. present & use formula & it will give you a # on a range

↳ example

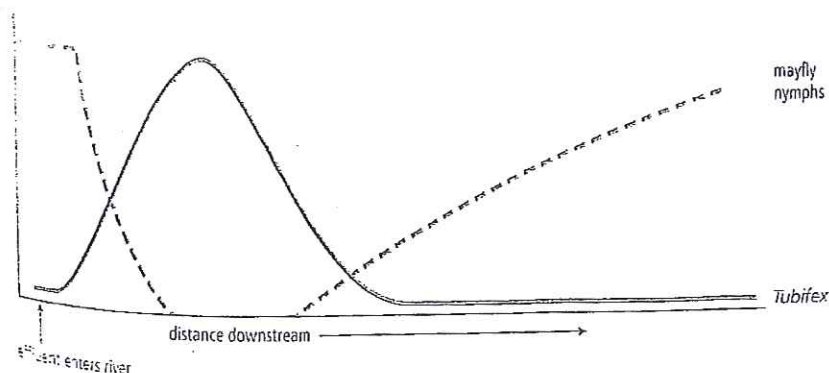
Sensitive	Somewhat Sensitive	Tolerant
<input type="checkbox"/> caddisfly larvae <input checked="" type="checkbox"/> hellgrammite <input type="checkbox"/> mayfly larvae <input type="checkbox"/> gilled snails <input type="checkbox"/> riffle beetle adult <input type="checkbox"/> Stonefly larvae <input type="checkbox"/> water penny larvae	<input checked="" type="checkbox"/> beetle larvae <input checked="" type="checkbox"/> clams <input type="checkbox"/> crane fly larvae <input checked="" type="checkbox"/> crayfish <input type="checkbox"/> damselfly larvae <input checked="" type="checkbox"/> dragonfly larvae <input type="checkbox"/> scuds <input checked="" type="checkbox"/> sowbugs <input checked="" type="checkbox"/> fishfly larvae <input type="checkbox"/> alderfly larvae <input type="checkbox"/> watersnipe larvae <input checked="" type="checkbox"/> whirligig beetle larvae	<input checked="" type="checkbox"/> aquatic worms <input checked="" type="checkbox"/> blackfly larvae <input checked="" type="checkbox"/> leeches <input checked="" type="checkbox"/> midge fly larvae <input checked="" type="checkbox"/> lunged snails
Boxes checked x 3 = <u>3</u> index value	Boxes checked x 2 = <u>14</u> index value	Boxes checked x 1 = <u>5</u> index value
TOTAL INDEX VALUE (SUM OF ALL CATEGORIES) <u>22</u>	Excellent (>22) <u>X Good (17-22)</u>	Fair (11-16) Poor (<11)

even though all the tolerant spp. are checked, there are lots of somewhat sensitive checked & one sensitive checked.

↓
Water Quality is "good"



← What Happens to BOD & Oxygen?



← What Happens to Tolerant Organisms (Tubifex) & Sensitive Organisms? (Mayfly nymphs)

Measure the amount of pollution (not the effects)

5.2.1 Describe two direct methods of monitoring pollution

- Soil → Assess a group of soil characteristics (soil texture, pH, density, infiltration, water holding, organic content, Nitrogen, Phosphorus, Potassium, Microbial Content, & Respiration)
- Also can check for specific contaminants like lead or cadmium

→ Water (see notes called "water tests")

- ↳ Chemical (Norp content, pH, ammonia, contaminants)
- ↳ Physical (Turbidity, Clarity, Conductivity, etc)

→ Air -

→ Smog

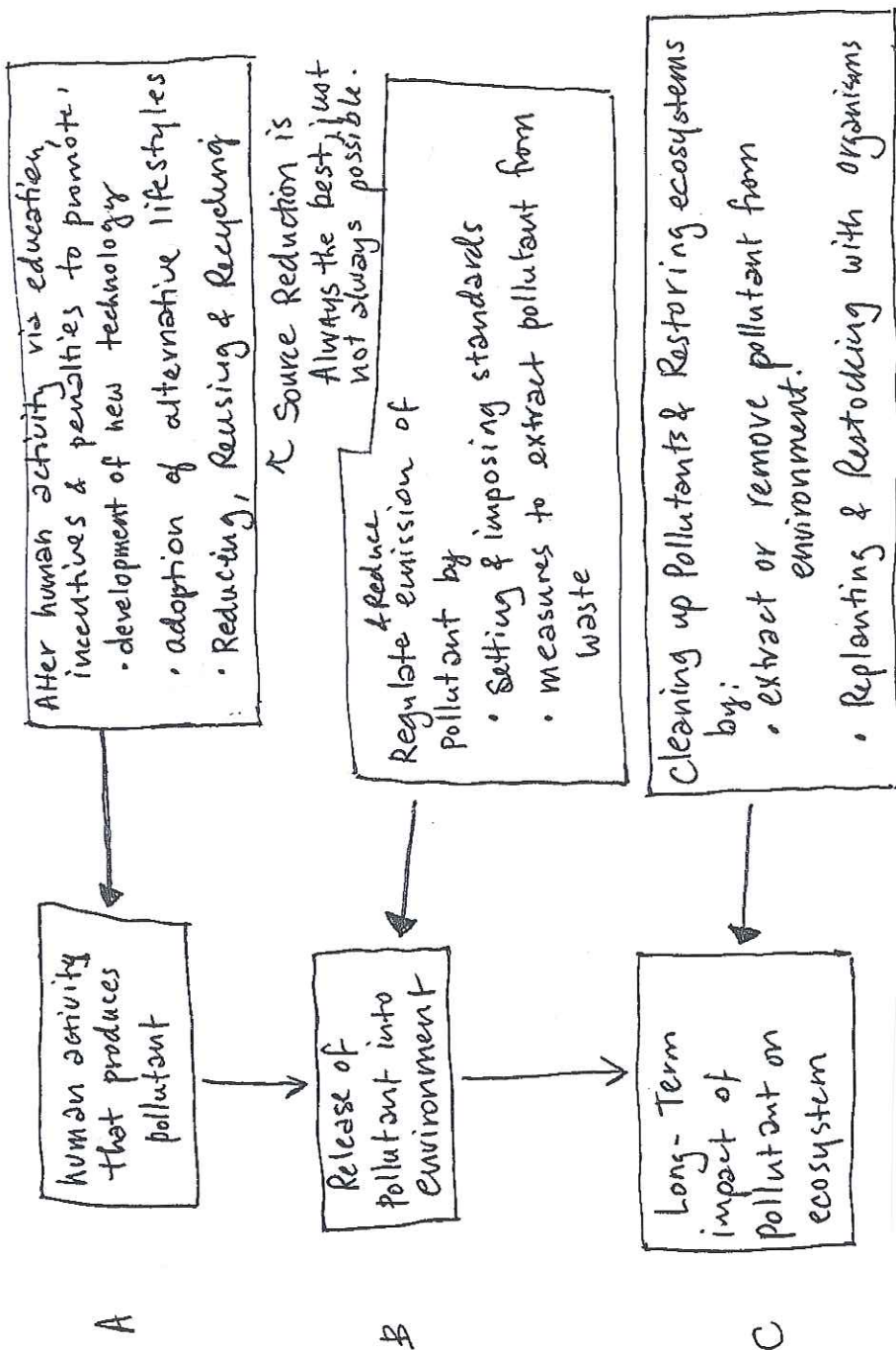
- ↳ chemical (SO_x , NO_x , ozone, VOCs, CO_2 , CO , CH_4)
- ↳ Particulates, Acid Precipitation

5.3.1 Outline approaches to pollution management with respect to figure 5

Process of Pollution

Fix

The "Replace, Regulate & Restore" Model



Plastic silverware made of corn starch

You can only drive in Beijing on certain days

Candy container made of recycled paper

Book made from recycled plastic

Using less fertilizer on fields

Using a bottle instead of buying water bottles

Making bags out of old tires

Saltwater pools instead of freshwater pools

Bamboo Bike

Banning DDT

Removal of Phosphates before sewage release

Montreal Protocol prohibited production of CFCs

Kyoto Protocol limited the production of greenhouse gasses

Carbon scrubbers on coal power plants

Cooling towers before effluent water is released